

REMARKS

In the Office Action dated October 1, 2008, claims 26-29, 31, 34-37 and 47-57 were examined with the result that all claims were rejected. The Examiner made the rejection non-final. In response, Applicant has canceled claims 29, 34, 48, 53, and 54 without disclaimer or prejudice to further prosecution on the merits. Further, Applicant has amended claims 26, 49, 51, 52, and 55-57, and added new claims 58-87. After entering the amendment, claims 26-28, 31, 35-37, 47, 49-52, and 55-87 are pending. In view of the above amendments and following remarks, reconsideration of this application is requested.

The Office Action dated October 1, 2008 asserts that that the claims are anticipated or alternately are obvious over Nagle et al. (U.S. Patent No. 4,921,531). Applicant respectfully traverses the rejection.

Nagel et al. disclose removing unwanted metal matrix from a composite by means of its chemical dissolution (*i.e.*, its lower chemical resistance) and/or its lower melting or boiling point compared to that of wanted second phase particles. In contrast to this, the process of the present application relies on the hardness of the second phase particles compared to the weaker metal matrix particles. This results in the metal matrix particles being reduced in size compared to the second phase particles (*i.e.*, the ceramic component) when the composite is exposed to crushing.

However, without acquiescing to the Office Action's assertion that the claims are anticipated or alternately are obvious over Nagle et al., Applicant has amended the claims in order to further prosecution. In particular, claim 26 has been amended and new claims 59 and 76 recite that the method results in a "metal rich fraction in powder form having a volume fraction of metal that is greater than about 60%." This is to further clarify that Applicant's process involves recovering a metal rich fraction as opposed to recovering ceramic particles as described in the prior art Nagle et al '531 reference cited by the Examiner. In previously rejecting claims 54 and 55, the Examiner stated:

With respect to claims 54 and 55, Nagle et al. ('531) does not specify the volume fraction of the metal component in the metal rich fraction as claimed. However, Nagle et al. ('531) discloses that the ceramic component is completely separated from the composite (col. 15, line 66 to col. 16, line 20), which obviously reads on the claimed feature, because after the complete separation of the ceramic component from the metal-ceramic based composite, the composite (i.e. the metal rich fraction as claimed) would inherently comprise mainly the metal component.

(See Office Action, page 6.) Reviewing this cited passage of Nagle, there is no indication that the ceramic component is completely separated from the composite as alleged. This passage states:

A third method for the separation of second phase particles from a metal matrix involves melting the metal and removing particles which are either non-wet by the liquid metal or which float to the surface or settle to the bottom of the melt due to a significant difference in density between the particles and liquid metal. In the non-wetting, or melt rejection process, the second phase particles are not wet by the molten solvent metal, or an alloy thereof, and are rejected to the outer surface of the molten metal. Thereafter, the particles may be removed by methods such as skimming or the like. It is noted that this process is limited to systems where second phase particles are not wet to any substantial degree by the solvent metal in which they are formed, or an alloy of the solvent metal in which they are formed. Alternatively, in certain instances where there is a significant difference in density between the second phase particles and the molten matrix metal, the particles may either float to the surface or settle to the bottom of the melt due to gravity effects. In this case, involving either flotation or sedimentation of the second phase particles, the particles may be removed from the melt by skimming, decanting, centrifuging and the like. In both of

(See Nagle, col. 15, line 66 to col. 16, line 20). The cited passage says nothing, either explicitly or inherently, regarding complete separation of the ceramic component from the composite.

Furthermore, Applicant respectfully disagrees that a method for removing a first component (*e.g.*, “X”) from a mixture of components (*e.g.*, a mixture “X/Y”), inherently is a method for purifying a second component (*i.e.*, “Y”) to a recited purity level. A method of removing X from a mixture of X/Y will provide a purified form of X and a mixture having an enhanced concentration of Y. However, Nagle says nothing about the purity level of the remaining metal in the composite or whether it has “a volume fraction of metal that is greater than about 60%,” either explicitly or inherently. Claims 55, 72, and 87 recite “a volume fraction of metal that is greater than about 90%.”

Nagle says nothing about the purity level of the remaining metal in the composite because the focus of Nagle’s method is purifying ceramic particles, not purifying a metal rich fraction. Because of this, it is difficult to understand the office action’s asserted “obviousness” with respect to modifying Nagle’s method in order to arrive at the presently claimed level of purity for the metal rich fraction. There is no motivation to modify Nagle’s method with respect to obtaining a higher purity level of remaining metal in the composite after the ceramic particles are removed from the composite because the focus of Nagle’s method is purifying ceramic particles.

In rejecting previous and now canceled claim 34, the office action asserted:

With respect to claim 34, Nagle et al. ('531) discloses that the volume fraction of metal component of the metal based composite is 10-95% (col. 9, lines 40-42), which overlaps the claimed ranges in the instant claim 34. A *prima facie* case of obviousness exists. See MPEP 2144.05 I.

(*See* Office Action, page 5). However, this cited passage refers to “solvent metal” used during a method for purifying ceramic particles, not to a metal rich fraction obtained after a method has been performed. For at least these reasons, the claims are patentable over Nagle.

In addition, claims 26, 59, and 76 recite that the crushing step reduces “the size of the metal rich fraction in the composite in comparison to the ceramic component in the composite.” This limitation relates to differential reduction in the size of the metal rich fraction versus the size of the ceramic component in the composite. In asserting that this limitation is obvious over Nagle, the office action states:

With respect to claim 51, Nagle et al. ('531) discloses that it is desired to decrease geometrical size of the composite by crushing or milling without limiting the crushing time or crushing and milling time as claimed (col. 15, lines 11-14). However, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the time of crushing or milling of Nagle et al. ('531) would be controlled not to reduce the size of the increase size of the component as claimed, because the increase size of the component is the desired size of the component as produced in the composite of Nagle et al. ('531) as disclosed by Nagle et al. ('531) (abstract).

(See Office Action, page 6). Applicant first notes that the claims do not recite that the crushing is performed “not to reduce the size of the increased size of the component.” Rather, the claims recite that the crushing “reduces the size of the metal rich fraction in the composite in comparison to the ceramic component in the composite” (*i.e.*, differential size reduction). Differential size reduction of the metal rich fraction versus the ceramic component is not the same as “not reducing the size of the ceramic component.” Differential size reduction of the metal rich fraction versus the ceramic component requires that the size of the metal rich fraction is reduced relative to the size of the ceramic component. Not reducing the size of the ceramic component says nothing about whether the size of the metal rich fraction is reduced. Because the focus of Nagle’s method is purifying ceramic particles, not purifying a metal rich fraction, whether the size of the metal rich fraction is reduced is of no import to Nagle. In fact, Nagle’s method requires dissolution of the metal matrix (see Nagle, col. 15, lines 11-14) after optional crushing, or optional melting of the metal (see Nagle, col. 15, line 67) after optional crushing. There is no teaching or suggestion in Nagle regarding differential size reduction of the metal rich fraction versus the ceramic component, as presently claimed. For at least these reasons, the claims are patentable over Nagle.

The claims include further limitations that render them patentable over Nagle. Claim 52 and new claim 60 recites the use of a “surfactant” in the separation process. In previously rejecting claim 52, the office action asserts that “Nagle further discloses that the powder is mixed with a dissolution medium (col. 22, lines 1-5), which reads on the claimed features of the instant

claims.” (See Office Action, page s 5-6). Applicant respectfully disagrees. The cited passage discloses:

microns. One gram of each of the composites is crushed to minus 50 mesh and added to 400 ml of a dissolution medium comprising a 1 molar aqueous solution of HCl. Each mixture is mechanically stirred for 18 hours and then filtered through a 0.2 micron membrane. The ma-

(See Nagle, col. 22, lines 1-5). Applicant respectfully requests that the office reconsider its position that a 1 molar aqueous solution of HCl meets the limitation “surfactant.” A 1M solution of hydrochloric acid is not a suspension comprising a surfactant. Further, claim 58 recites “wherein the surfactant comprises sodium dodecyl sulphate.” Nagle does not teach or suggest the use of a surfactant, let alone sodium dodecyl sulphate (SDS). Applicant has found that the use of surfactants, such as SDS, is advantageous in the claimed process:

The coating of the surfactant onto the powder particles provides a number of advantages. While the sizes of the particles rich in different components of the composite have been differentiated by the grain coarsening process and further milling processes, if they were simply suspended in water (or a similar solvent), the sedimentation rate would be too high to differentiate the sedimentation times of the two types of powder particles. The addition of the surfactant assists suspension of the small particles in the liquid for a longer time and ensures the break up of the agglomerate and separation of the particles, and thus allows the larger, heavier Al_2O_3 rich particles to fall, as a sediment, well ahead of the smaller $\text{Ti}_x\text{Al}_y(\text{O})$ rich particles.

(See specification, page 8, line 33 to page 9, line 5). Nagle does not teach or suggest the use of surfactant or that the use of a surfactant would provide these advantages for preparing a metal rich fraction. For at least these reasons, claims 26-28, 31, 35-37, 47, 49-52, 55-58, and 60 are patentable over Nagle.

Claim 59 also recites “reacting the metal rich fraction with a reducing agent, and leaching the metal rich fraction with an acid to remove products of the reduction reaction.” Claim 74 recites “wherein the reducing agent comprises calcium or calcium hydride.” Claim 75 recites

“wherein the acid comprises formic acid or acetic acid.” Nagle does not teach or suggest leaching the metal rich fraction with an acid to remove the products of a reduction reaction. Further, Nagle does not teach or suggest the use of calcium or calcium hydride as a reducing agent or the use of formic acid or acetic acid for a leaching step. For at least these reasons, claims 59-75 are patentable over Nagle.

Claim 76 also recites “separating a sufficient amount of the increased sized ceramic component from the other components of the crushed composite by a method that includes electrophoresis or magnetic separation.” Nagle does not teach or suggest electrophoresis or magnetic separation as separation steps. Furthermore, because the focus of Nagle’s method is purifying ceramic particles, not purifying a metal rich fraction, Nagle would not look to steps such as electrophoresis or magnetic separation as separation steps for purifying the ceramic particles. For at least these reasons, claims 76-87 are patentable over Nagle.

An effort has been made to place this application in condition for allowance and such action is earnestly requested.

Respectfully submitted,

ANDRUS, SCEALES, STARKE & SAWALL, LLP

By M. Scott McBride
M. Scott McBride, Ph.D.
Reg. No. 52,008

100 East Wisconsin Avenue, Suite 1100
Milwaukee, Wisconsin 53202
Telephone: (414) 271-7590
Facsimile: (414) 271-5770